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Minimizing Costs of SCR Catalyst Replacement

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NO_x control legislation calls for significant NO_x reductions from utility boilers over the next five years. An estimated 100,000 MW of generating capacity will be affected by this legislation and be required to reduce NO_x. Of this capacity, 30 to 50% is expected to require post-combustion NO_x control in the form of urea- and ammonia-based SCR and SNCR. Of primary concern to all parties involved is the cost of these technologies, particularly retrofit costs of SCR.

While there are differing opinions as to the timetable for implementation of these control technologies, most agree that it is only a matter of time until utilities and IPPs will be required to invest in SCR and SNCR for NO_x control. To protect their investment, those units which employ SCR need to develop a regular maintenance plan for the catalyst and system which includes regular catalyst testing, system inspection, ammonia injection system tuning and the development of catalyst replacement strategies.

SCR catalysts deactivate non-uniformly. Catalyst sites in the reactor entrance are typically poisoned more rapidly than those in the reactor exit. Regions of high flow are exposed to higher concentrations of contaminants than regions with low flow. High flow regions are therefore expected to lose performance more rapidly. Only through regular monitoring of catalyst performance and deactivation can the proper maintenance strategy be developed. Catalyst replacement strategies and management plans should take the non-uniform deactivation process into account. A replacement strategy developed at the time of design is not typically the optimum strategy for the unit. Concentrations of catalyst foulants and poisons often differ significantly from expected performance at the time of design.

While all SCR systems can benefit significantly from regular catalyst testing and proper maintenance, multiple-layer systems typically achieve more optimum catalyst consumption rates than single layer systems. Replacement of the most severely deactivated catalyst layers can extend the useful life of the remaining partially deactivated layers by a significant period of time. Also, systems designed with space for adding future layers benefit from additional flexibility to extend the useful life of the entire catalyst bed.

Proper SCR system design and regular maintenance are essential to maximizing SCR catalyst useful life and minimizing costs. The presentation discusses the most economic catalyst replacement options, taking into account the overall performance requirements of the unit, the costs of replacement catalyst and pressure drop, the activity of newly developed catalyst which has improved over those offered five years ago, and partial deactivation of different segments of the catalyst bed.